**Calculus AB Review Limits and Derivatives** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1) Answer the following using the graph of f(x) shown below.

(a) f(0) =

(b) f(3) =

(c) $\lim\_{x\to -5}f(x)$ =

(d) $\lim\_{x\to 0^{+}}f(x)$ =

(e) $\lim\_{x\to 3^{-}}f(x)$ =

2) Let $f\left(x\right)=\left\{\begin{array}{c}3x^{2}+1,x<1\\4x, x\geq 1 \end{array}\right.$. Which of the following is true?

 I. f(x) is continuous at x = 1

 II. f(x) is differentiable at x = 1

 III. $\lim\_{x\to 1^{-}}f(x)=\lim\_{x\to 1^{+}}f(x)$

(A) I only (B) II only (C) III only (D) I and III only (E) II and III only

3) $\lim\_{h\to 0}\frac{cos\left(\frac{π}{6}+h\right)-cos\left(\frac{π}{6}\right)}{h}=$

(A) Does not exist (B) 1/2 (C) -1/2 (D) $\sqrt{3}$/2 (E) $-\sqrt{3}$/2

4) Find the value of the limit: $\lim\_{h\to 0}\frac{\sqrt{tan\left(2x+2h\right)}-\sqrt{tan⁡(2x)}}{h}$

5) Let *f* be a differentiable function with *f*(2) = 3 and *f ‘*(2) = -5, and let *g* be the function defined by
 $g\left(x\right)=x∙f(x)$. What is the equation for the line tangent to the graph of *g* at the point where x = 2?

**Find the derivatives of the following functions.**
6) f(x) = (3x2 + 7)(x2 – 2x + 3) 7) f(x) = $\sqrt{x}∙sinx$

8) f(x) = 3x2sec3x 9) f(x) = $\frac{x^{4}+x}{tan^{2}x}$

10) Given the equation y = sin(3x + 4y), find $\frac{dy}{dx}$.

11) Suppose that *f* and *g* are twice differentiable functions having selected values given in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *x* | *f(x)* | *f'(x)* | *g(x)* | *g'(x)* |
| 1 | 5 | 4 | 2 | 7 |
| 2 | 8 | 6 | -6 | -4 |

If *h(x) = f(g(x))*, what is the value of *h’(x)* at the point where x = 1?

12) A particle moves along the x-axis according to the position function x(t) = 3sin(2t) + 1.

(a) Determine the instantaneous velocity of the particle at t = π. Which direction is the particle moving?

(b) What is the acceleration of the particle at t = $\frac{π}{4}$ ?

(c) Is the particle speeding up or slowing down at t = $\frac{π}{4}?$ Justify your answer.

13) If the nth derivative of y is denoted as y(n) and y = -sinx, then y(14) is the same as

(A) y

(B) $\frac{dy}{dx}$

(C) $\frac{d^{2}y}{dx^{2}}$

(D) $\frac{d^{3}y}{dx^{3}}$



14)

The graph of *y = f(x)* on the closed interval [0, 4] is shown above. Which of the following could be the graph of *y = f ’(x)*?

(A) (B) (C) (D)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| t (hours) | 0 | 1 | 3 | 4 | 7 | 8 | 9 |
| L(t) (people) | 120 | 156 | 176 | 126 | 150 | 80 | 0 |

15)

Concert tickets went on sale at noon (t = 0) and were sold out within 9 hours. The number of people waiting in line to purchase tickets at time t is modeled by a twice-differentiable function L for 0 ≤ t ≤ 9. Values of L(t) at various times t are shown in the table above.

(a) Use the data in the tale to estimate the rate at which the number of people waiting in line was changing at 5:30 P.M. (t = 5.5). Show the computations that lead to your answer. Indicate units of measure.

(b) For 0 ≤ t ≤ 9, what is the fewest number of times at which L’(t) must equal 0? Give a reason for your answer.

(c) Is there a time on the interval [1, 4] where the rate at which the number of people waiting in line was decreasing at a rate of 10 people per hour? Justify your answer.


16) The figure below shows the graph of f ‘, the derivative of a twice differentiable function f, on the closed interval 0 ≤ x ≤ 8. The graph of f ‘ has horizontal tangent lines at x = 1, x = 3, and x = 5, and the function f is defined for all real numbers.

(a) Find all values of x on the open interval 0 < x < 8 for which the
function *f* has a local maximum. Justify your answer.

(b) On what open intervals contained in 0 < x < 8 is the graph of *f* both concave down and increasing? Explain your reasoning.

(c) Does the tangent line to the graph of y = f(x) at the point where x = 4 lie above or below the curve near that point? Justify your response.